

## **REAR LOADER COLLECTION VEHICLE WITH DETACHABLE CONTAINER**

### **CROSS REFERENCE TO RELATED APPLICATION**

This application claims the benefit of U.S. Provisional Application No. 60/399,942, which was filed on July 30, 2002.

### **FIELD OF THE INVENTION**

This invention relates generally to a rear-loading refuse collection vehicle. More particularly, the invention relates to such a collection vehicle in which a storage container for refuse may be detachably mounted on the vehicle and removed therefrom. In a preferred embodiment of the invention, the detachable storage container generally has the dimensions of a standard intermodal shipping container.

### **BACKGROUND AND DESCRIPTION OF THE PRIOR ART**

Several different types of vehicles are commonly used for collection of household and commercial refuse. Some types of refuse collection vehicles are rear-loading, in which a packer mechanism is adapted to move refuse deposited in a hopper that is a part of the tailgate assembly into a storage compartment that is permanently mounted on the vehicle. Other types of refuse collection vehicles are front-loading or side-loading. It is also known to provide a collection vehicle in which a storage compartment is detachably mounted on the vehicle. Such vehicles are described in U.S. Patent No. 3,370,525 of Bowles, U.S. Patent No. 4,934,896 of Quinto, U.S.

Patent No. 5,562,390 of Christenson, U.S. Patent No. 5,725,350 of Christenson and U.S. Patent No. 5,938,393 of Georg.

In addition, U.S. Patent No. 3,365,087 of Roedel et al. describes a rear loading vehicle with a detachably mounted storage compartment having a sloped rear wall that is provided with a hinged door that may be opened to provide access for deposit and compaction of refuse through the door opening. U.S. Patent No. 3,380,600 of Klanner et al. describes a rear loading vehicle with a detachably mounted storage compartment and a tailgate assembly that includes support arms that are pivotally mounted to the vehicle in front of the removable storage compartment. U.S. Patent No. 3,817,415 of Lewis describes a rear loading vehicle with a detachably mounted storage compartment and a detachably mounted tailgate assembly. All of these rear loading vehicles with detachably mounted storage compartments have a number of disadvantages. The storage compartments of the Roedel and Klanner vehicles have no means other than sloping rear walls to prevent compacted trash from rebounding or otherwise spilling out of the storage compartment when the packing mechanisms are removed therefrom. Furthermore, the Roedel and Klanner vehicles are not susceptible to use with standardized storage containers. In addition, operation of the Klanner vehicle requires the tailgate assembly to be moved above the container and the container dragged from beneath the tailgate assembly in order to remove the container from the vehicle. Although the Lewis vehicle may be used with a standardized container, its rear loader assembly must be completely disengaged from the vehicle and mounted on a support stand before the container can be removed.

Standard-sized containers (sometimes referred to as intermodal containers because many of them can be carried by various modes of transport) are widely used for transport and temporary storage of various products. Such containers include a container enclosure that is mounted within a standardized container frame which is adapted for stacking with other similar containers and (usually) for shipment by rail, truck or ship. The most common containers that are hauled by truck are 10 or 20 feet long, 8 feet wide and 8.5 feet high. Various other sizes are also in use. In order to be commercially successful, containers for intermodal shipping must be designed and built to internationally recognized standards such as those issued by the United Nations, the International Standards Organization (ISO) and the Association of American Railroads (AAR). These organizations promulgate standards for such containers relating to all facets of handling and carriage, including, among other things, strength, size, weight and materials used in the construction of the container. Applicable standards for intermodal shipping containers such as are described herein include ISO 1496/IV, AAR M-930, the United Nations' Council for Safe Containers (CSC) and Customs/TIR.

It would be desirable if a rear-loader refuse collection vehicle could be developed that could be used to store and compact refuse in a standardized removable storage container. It would also be desirable if such a vehicle could be developed that would not require the removal of the tailgate assembly or any complicated removal procedure for moving the container off of the vehicle. It would also be desirable if such a vehicle could be developed that could be operated in such a way that there would be little risk of compacted refuse rebounding or otherwise spilling out of the container.

## **ADVANTAGES OF THE INVENTION**

Among the advantages of the invention is that it allows for use of a removable container from a rear loading refuse collection vehicle with minimal modification of the container components.

Another advantage of the invention is that it allows for removal of a storage container from the vehicle without requiring removal of the tailgate assembly from the vehicle. Still another advantage of the invention is that it does not require a complicated procedure or mechanism for moving the container off of the vehicle. Yet another advantage of the invention is that a rear loading vehicle so equipped may be operated in such a way that there is little risk of compacted refuse rebounding or otherwise spilling out of the container.

Additional objects and advantages of this invention will become apparent from an examination of the drawings and the ensuing description.

## **EXPLANATION OF TECHNICAL TERMS**

As used herein, the term "**actuator**" refers to a device that imparts linear or rotational motion to a component. The term "**actuator**" thus includes hydraulic actuators or cylinders, pneumatic actuators, motors, motorized drives, levers, springs, gear systems and combinations thereof.

As used herein, the term "**hopper**" refers to that portion of the tailgate assembly of a rear loading refuse collection vehicle into which refuse may be deposited.

As used herein, the term "**front**", when used in reference to a vehicle, refers to the end of the vehicle where the cab is located. When used in reference to a container that is mounted or

mountable on a vehicle, the term "**front**" refers to the end of the container nearest the cab of the vehicle when the container is mounted thereon.

As used herein, the term "**rear**", when used in reference to a vehicle (or to a container that is mounted or mountable on a vehicle), refers to the end of the vehicle (or the container) opposite the front end.

### **SUMMARY OF THE INVENTION**

The invention comprises a rear loading refuse collection vehicle having a rear tailgate assembly and a detachably mounted container having a rear wall which is provided with an opening and a sweep panel mounted over the opening. The sweep panel may be moved between an open position which exposes the opening and a closed position which covers the opening. Opening of the sweep panel provides a path to the storage container for refuse material that is deposited in the hopper of the tailgate assembly of the vehicle. A packer moves the refuse material from the hopper to the opening in the rear wall of the container. The sweep panel and the tailgate assembly are arranged and configured so as to minimize the spilling of refuse from the opening of the storage container into the hopper as the sweep panel is moved from the open position to the closed position.

In order to facilitate an understanding of the invention, the preferred embodiments of the invention are illustrated in the drawings, and a detailed description thereof follows. It is not intended, however, that the invention be limited to the particular embodiments described or to use in connection with the apparatus illustrated herein. Various modifications and alternative

embodiments such as would ordinarily occur to one skilled in the art to which the invention relates are also contemplated and included within the scope of the invention described and claimed herein.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The presently preferred embodiments of the invention are illustrated in the accompanying drawings, in which like reference numerals represent like parts throughout, and in which:

Figure 1 is a rear perspective view of a preferred rear loading refuse collection vehicle constructed according to the invention, with the preferred tailgate assembly shown in partial section.

Figure 2 is a rear perspective view of the preferred tailgate assembly of the vehicle of Figure 1.

Figure 3 is a front perspective view of the removable container that is a part of the preferred embodiment of the invention illustrated in Figure 1.

Figure 4 is a rear perspective view of the removable container that is a part of the preferred embodiment of the invention illustrated in Figure 1.

Figure 5 is a rear perspective view of the preferred vehicle of Figure 1, with the tailgate assembly removed and the container raised above the chassis of the vehicle.

Figure 6 is a front perspective view of the preferred vehicle of Figure 1, showing the tailgate assembly tilted back from the container to permit easy removal of the container from the vehicle.

Figure 7 is a front perspective view of the preferred embodiment of the vehicle illustrated in Figures 1, 5 and 6, with the container removed.

Figure 8 is a front perspective view of the preferred embodiment of the vehicle illustrated in Figures 1 and 5-7, showing the tailgate assembly tilted forward for travel without a container mounted on the chassis.

Figure 9 is a front perspective view of an alternative embodiment of the vehicle illustrated in Figures 1 and 5-8, showing an alternative tailgate assembly that may be tilted backward for travel without a container mounted on the chassis.

Figure 10 is a side view of the preferred tailgate assembly of the embodiment of the invention illustrated in Figures 1, 2 and 5-8.

Figure 11 is a front perspective cut-away view of the preferred tailgate assembly and container showing the sweep panel of the container in the open position.

Figure 12 is a front perspective cut-away view of the preferred tailgate assembly and container showing the sweep panel of the container in the closed position.

## **DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION**

As shown in Figure 1, preferred vehicle 10 includes chassis 12, cab 14, container 16 and tailgate assembly 18. The chassis includes at least one cross-member 20 (best shown in Figure 5) for supporting a container of a particular length at or near its front end, and may include a similar cross-member (not shown) for supporting the container at or near its rear end. The chassis may also include additional cross-members (not shown) for supporting containers of different lengths. As shown in Figures 1 and 3-6, preferred container 16 includes a supporting frame having a pair of generally rectangular end pieces 22 and 24, each of which is comprised of four interconnecting frame components 22a, 22b, 22c and 22d, and 24a, 24b, 24c and 24d respectively (Figures 3 and 4). End pieces 22 and 24 are preferably connected by a pair of top rails 26 and 28 and a pair of bottom rails (only one of which, bottom rail 30, is shown in the drawings). As shown in Figures 3 and 4, in the preferred embodiment of the invention, one of each pair of rails is located on either side of the container body; however, in an alternative embodiment (not shown), the top rails may be omitted. The container body is comprised of a pair of container sidewalls (only one of which, sidewall 32 is shown), top wall 34, a bottom wall (not shown), front wall 36 and rear wall 38. One or more bottom rails 39 (Figure 5) may be provided to reinforce the bottom of the container. The side rails, bottom rails and frame components of the end pieces are preferably comprised of formed channels or tubing having a square or rectangular cross-section, and the walls are preferably comprised of steel or aluminum sheet. At the corners of end pieces 22 and 24 are located corner castings 40, which are adapted to receive locks 42, which are located at the ends of the cross-members 20 and adapted to secure the container to the chassis. The corner castings may also be employed in lifting and

transporting the container. In addition, the container may be lifted by a fork lift using lift channels 44.

As shown in Figure 3, front wall 36 of preferred container 16 is hinged at the top so that it may swing open to allow for removal of refuse therefrom, as by, for example, tilting the container. The bottom of front wall 36 is also preferably provided with a sealing mechanism to seal against liquids (not shown) and locking pins (also not shown) that engage with holes (also not shown) in end piece 22 or other means of locking the front wall with respect to the end piece to allow for transport and temporary storage of refuse within the container. Rear wall 38 of preferred container 16 is provided with an opening and a sweep panel 46 that is pivotally attached at the top of the end wall along pivot axis 47 (Figure 4). As illustrated in Figures 4 and 5, the sweep panel is movable between an open position which exposes the opening in the rear wall (Figure 4) and a closed position which covers the opening in the rear wall (Figure 5). Preferably, the rear wall is also provided with fixed dam 48 in order to minimize the risk that liquids will spill out of the container when it is being used to transport or store refuse. The sweep panel is also preferably adapted to be fixed in place in its closed position (shown in Figure 5) by pins (not shown) which may be pneumatically actuated to engage holes 50 (only one of which is shown in Figure 4) on opposite sides of the sweep panel. Opening of sweep panel (as hereinafter explained in more detail), as shown in Figure 4, will expose the opening therebeneath (and above dam 48) through which refuse may be placed into the container.

As best shown in Figure 7, preferred tailgate assembly 18 is pivotally mounted to chassis 12 along pivot axis 52. Hydraulic actuator 54 is also preferably attached between chassis 12 and the

tailgate assembly and is adapted to pivot the tailgate assembly so as to permit container 16 to be removed from the vehicle, as shown in Figure 6. With the container removed, the tailgate assembly may be tilted forward for travel, as shown in Figure 8. In an alternative embodiment illustrated in Figure 9, tailgate 118, identical to tailgate 18 except for the addition of roller 120, may be tilted rearwardly so that roller 120, or a similar wheeled structure, may rest on and roll along the road surface for travel with the container removed. As shown in Figures 6 and 7, preferred tailgate assembly 18 includes locking mechanisms for attaching the tailgate assembly to the container. The preferred locking mechanisms are a pair of hydraulic actuators 56 and 57, which are adapted to engage pins 58 and 59 into holes (only one of which, hole 60, is shown in Figure 6) in end piece 24 of container 16.

Referring now to Figures 1, 2 and 10-12, tailgate 18 includes a hopper into which refuse may be deposited from the rear of vehicle 10. The hopper is defined by tailgate sidewalls 62 and 63, hopper floor 64 and front plate 65. The front plate preferably extends in an arcuate configuration to the top of dam 48 on rear wall 38 (see Figure 5) of container 16. The tailgate assembly includes a packer 66 (best illustrated in Figure 10) comprised of packer panel 68 and a plurality of packer end plates 70 (only one of which is shown in Figure 10). The tailgate assembly also includes fixed deflector plate 71, a pair of links 72 (only one of which is shown in Figure 10), a first pair of hydraulic actuators 73 (only one of which is shown in Figure 10) and a second pair of hydraulic actuators 74 (only one of which is shown in Figure 10). The base end 75 of actuator 73 is preferably pivotally attached to the inside of a tailgate sidewall at pivot mount 76, and the base end 78 of actuator 74 is preferably pivotally attached to the outside of a tailgate sidewall at pivot mount 79. Each of links 72 is preferably pivotally attached at a first end 80 to an extension

bracket 81 of the tailgate assembly that is located adjacent to or in front of front plate 65. A pair of link pins 82 (only one of which is shown in Figure 10) are also provided to connect each of links 72 at its second end 83 to the extension end 84 of one of actuators 74. As shown in Figure 10, each link pin extends through a packer end plate 70 at an intermediate position, through the second end of link 72 and the extension end of actuator 74, and through curved slot 85 in the sidewall of the tailgate assembly. The links 72 and hydraulic actuators 74 attached thereto are located within exterior enclosure 86 (one of which is shown in Figure 2). The extension end 87 of each of actuators 73 is preferably attached to packer end plate 70 at rear end pivot point 88. The configuration of packer 66 and the cooperation of link 72, link pin 82 and slot 85, along with the action of actuators 73 and 74, defines the motion of packer panel 68 within the tailgate assembly. Referring now to Figures 2, 10 and 11, it can be appreciated that if actuator 74 were extended and actuator 73 retracted, packer panel 68 would be open so that front end 89 would be located at the rear end 90 of hopper floor 64. Extension of actuator 73 would then cause front end 89 of packer panel 68 to follow the contours of hopper floor 64 to its intersection with front plate 65, sweeping any refuse in the hopper before it. Retraction of actuator 74 will then cause front end 89 of packer panel 68 to follow the contours of front plate 65, carrying refuse from the hopper up to and through the opening in the container created by the opening of sweep panel 46 (see also Figure 11). In the preferred embodiment of the invention, one end of each of a pair of hydraulic actuators (one of which, actuator 91, is shown in Figure 10) is connected to bracket 92, preferably by a trunnion mount, that is attached to fixed deflector plate 71. The other ends of the actuators are attached to sweep panel 46 by a pair of pneumatic cylinders 93 and 94 (Figures 4 and 5), which are adapted to engage pins 96 and 97 into holes (only one of which, hole 98, is shown in Figure 10) in the ends of the hydraulic actuators. As understood by comparing Figures

11 and 12 and the representations of sweep panel 46 in solid lines and dashed lines in Figure 10, extension of the hydraulic actuators attached to sweep panel 46 will cause the sweep panel to move from the open position of Figure 11 (corresponding to the representation of sweep panel 46 in dashed lines in Figure 10) to the closed position of Figure 12 (corresponding to the representation of sweep panel 46 in solid lines in Figure 10). As the actuators are extended, lower end 99 of panel 46 will follow the contours of packer panel 68 (corresponding to dashed line 100 of Figure 10) and sweep any refuse material retained thereon into the container. Thus, the arrangement and configuration of the preferred sweep panel and packer assembly results in cooperation between the sweep panel and the packer assembly as the sweep panel is moved from the open position to the closed position to substantially eliminate or minimize the spilling of refuse material from the opening of the storage container into the hopper. The action of the sweep panel in sweeping across the packer panel will also assist in packing refuse in the container, and it will serve to close off the container so that it may be removed from vehicle 10.

Preferably, the actuators attached to the sweep panel are double acting hydraulic actuators which are adapted to move the sweep panel between the open and the closed positions illustrated by Figures 11 and 12. However, it is also contemplated that other mechanical actuators could be employed to move the sweep panel between the open and closed positions. Thus, for example, a motor (not shown) could be provided to move the sweep panel between the open and closed positions. The sweep panel could also be mounted on a shaft along axis 47 (Figure 4) having a torsion spring thereon that is adapted to hold the sweep panel in either the open or the closed position. A motor, single acting hydraulic actuator, lever or ratcheted gear system could be employed to move the sweep panel against the action of the torsion spring.